Zero Retries 0237

2026-02–06 - Zero Retries Digital Conf 2026 - October 16 in San Ramon, CA, Thought Experiment - Top 3 Priorities for ZR Interesting AR In the Next 3 Years, Petition for Rulemaking - Encryption

Steve Stroh N8GNJ

Zero Retries is an independent newsletter promoting technological innovation in and adjacent to Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Radios are computers - with antennas! Now in its fifth year of publication, with 3400+ subscribers.

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This issue of Zero Retries was originally published on Ghost - https://www.zeroretries.radio/zero-retries-0237/. Thus all links that were for zeroretries.radio have (attempted to) been changed to equivalents on zeroretries.org.

See this archive page:
https://web.archive.org/web/20260412225455/https://www.zeroretries.radio/zero-retries-0237/
for how it originally appeared on www.zeroretries.radio

*Substack says this issue is **too big for email clients**. Thus, it might be easier to read in a web browser - https://www.zeroretries.org/p/zero-retries-0237-924.*

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- **Closing Thanks**
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Request To Send

It will take me a while to figure out formatting (and using Markdown). Thus the form and formatting of these early issues published on Ghost won't be as "polished" as I was doing on Substack, in deference to pushing out Zero Retries on schedule(ish) on (new to me) Ghost.

The Saga of the Conversion to Ghost and zeroretries.radio - Part 4

Post Publication Update *- If you're reading this after 2026-04-03, the conversion to* ***Ghost / www.zeroretries.radio*** *didn't work out and Zero Retries is again being published on Substack / www.zeroretries.org. Thus the info in this section is retained solely for historical reference.*

I've decided that for at least the immediate future, Zero Retries will be published with the URL of

www.zeroretries.radio

It *works*, and my goal of being able to specify just zeroretries.radio when that's convenient, like on a business card or QSL card, has been satisfied.

Thus it's time to proceed with the next stage of migration to Ghost:

- Attempt migration of all email subscribers currently subscribed to Zero Retries in Substack, and
- Set up payment capability in Ghost for those subscribers that wish to optionally support Zero Retries financially. This is the same arrangement currently used with Substack. All Zero Retries content is available free; paid subscribers get a few extras (and additional extras in 2026), but the content will be the same for free and paid subscribers.

It will be interesting to see how this goes. There are 3400+ email subscribers on "Substack" Zero Retries, and already 100+ have subscribed on "Ghost" Zero Retries.

As for the Ghost editor, I've established templates and other customizations, and gotten familiar with more of the nooks and crannies of Ghost. In the end, it's just another tool, and the more I use it the more comfortable it feels and the more productive I am... but to date using the Ghost editor is still a

low-grade tussle. I discovered that one of my favorite editing hacks - using tk, works great in the Ghost editor.

Weekends Are For Amateur Radio!

Some units have arrived for use and review in N8GNJ / Zero Retries Labs and I need to get going on those. Not to mention the “other” new radios (see ZR > BEACON). The weather oracle promises (100%!) rain this weekend, but moderate temps, so the Lab will be tolerable and perhaps I can get in some *Amateur Radio Fun!* even with minimal sunlight and the shop doors closed.

Have a great weekend, all of you co-conspirators in Zero Retries Interesting Amateur Radio activities!

Steve N8GNJ

*Please direct comments / feedback about **Request To Send** to the Zero Retries email list with the #zr0237 hashtag.*

Breaking - Zero Retries Digital Conference 2026 - October 16 in San Ramon, California

By Tina Stroh KD7WSF
Zero Retries Conference Manager

It is with great excitement that we are able to announce the Zero Retries Digital Conference (ZRDC) 2026 will be held on Friday, October 16, 2026 in San Ramon, California. The Roundhouse Conference Center is a short walk from The San Ramon Marriott Hotel where Pacificon 2026 will be held on Friday, October 16 thru Sunday, October 18. We are also planning some informal activities for ZRDC 2026 attendees on Thursday, October 15.

The conference will follow the same general format as ZRDC 2025 in regard to schedule. Over the next few weeks and months, Steve will be putting together a panel of speakers who will offer presentations on new and emerging technologies in Amateur Radio. In addition, Steve will offer a conspectus of ZRDC 2025, updating ZRDC attendees on the progress of projects presented and discussed at ZRDC 2025.

Now that the major contracts have been signed, I will be building out the conference page and will announce when registration will be open. Given that this conference will be held in San Ramon, California where there is a higher concentration of Amateur Radio Operators with a technical focus, we expect the available tickets to sell out quickly. So when the announcement is made that registration is open, please don’t hesitate in purchasing a ticket.

In the meantime, if you have any questions, concerns or suggestions for the conference, please don’t hesitate to contact me directly at tina@zeroretries.net.

See you in October!

Please direct comments / feedback about this article to the Zero Retries email list with the #zrdc hashtag.

Thought Experiment - Top Three Priorities for Zero Retries Interesting Amateur Radio In the Next Three Years; Part 1 of 3 - Inputs

By Steve Stroh N8GNJ

To keep issue length (more) reasonable, I've divided this long article into three consecutive installments.

- *Part 1, below incorporates summations of the inputs provided.*
- *Part 2, planned for Zero Retries 0238 will be a consolidation and synthesis of the ideas into some broader themes for consideration of the Top Three Priorities for Zero Retries Interesting Amateur Radio in the Next Three Years.*
- *Part 3, planned for Zero Retries 0239 will be my opinions and my perspective of the **Top Three** Priorities for Zero Retries Interesting Amateur Radio in the **Next Three Years**.*

On 2026-01-01, I wrote this on the Zero Retries email list:

Something that would help me in Zero Retries (and Amateur Radio) is figuring out what should be the focus of efforts promoting Amateur Radio in the 21st century. I'm pinging knowledgeable folks with this query (some of whom were bcc'd on this email that probably aren't on the Zero Retries email list). What should the priorities for Amateur Radio be…

- *In the next… three years?*
- *Three items, max?*
- *Doesn't have to be practical / achievable / realistic.*

I don't know what such items should be quite yet. But before one can charge off to a battle… one needs to know which direction to plant your feet. So here's a few ideas to start the conversation.

- *US Amateur Radio reform to remove the symbol rate limits and (preferably) bandwidth limits for the US Amateur Radio VHF / UHF bands.*
- *A more modern "single web page" directory for 21st century Amateur Radio that, for example, references Zero Retries, SARC The Communicator, the reference how.aprs.works for APRS, the upcoming ARRL book on digital networking, the RATPAC video conferences, references to HamSCI, etc. Something that someone thinking about coming into Amateur Radio would find relevant.*
- *Some guide, book, web page, video tutorials… something… current… that discusses how to use GNU Radio and GNU Radio Companion for experiencing within Amateur Radio. Includes a directory of various GNU Radio flowgraphs relevant to Amateur Radio such as a flowgraph about 1200 bps AFSK packet radio.*

Thanks for your ideas!

Happy 2026!

(Only) 3 Ideas, (Only) 3 Years?

A natural question probably arises - why ***3*** ideas, max, and why a time horizon of ***3*** years?

In part, I was inspired by ARDC's Priority Areas for Funding statement, published in 2025-04. I consider that statement an admirable distillation of what ARDC considers as its (3) priorities for funding "most impactful" grants.

- ***3 priorities*** is, in my opinion, the maximum that can be accommodated in one's mind as (equal) priorities.

    - Less than three is too narrow a focus for the many challenges ahead, and changes needed in Amateur Radio.
    - More than three... that's not really prioritizing. We each, and we all, have only so much energy, and only so much "focus" available.

- ***3 years*** is a reasonable time horizon for this thought experiment. "Things" will be radically different by the end of the next three years, thus there's little point in a longer time horizon. For these ideas to potentially "get traction", we have the remainder of 2026, and all of 2027 and 2028, comfortably before the end of this decade. I'm imagining...
    - AI capabilities will have evolved through multiple generations. Probably any techie will be able to design software (and likely software radios) and hardware by then.
    - We'll have even more processor power available, at even lower cost to bring to bear on challenges and opportunities in Amateur Radio.
    - We'll have even better (software-based) radio technology available, available, at even lower cost to bring to bear on challenges and opportunities in Amateur Radio.

Responses

There were many good responses - see the link above for the individual contributor's actual statements and the entire discussion thread (now locked). The following items were edited for publication.

Joe Hamelin W7COM

1. Better digital audio. We don't have the problem of FCC mandated spectrum efficiency like LMR does. We're using their highly compressed codecs because that's what's readily available. Clear "toll quality" audio should be our standard, not trying to fit voice into 6.25kHz channels for repeaters that are 99.9% quiet. G.726 (https://en.wikipedia.org/wiki/G.726), an open, standardized ITU-T audio codec for voice, works for several bit rates and is standard in the VoIP world. There is a lot of silicon out there for that. This is why M17 is important as a base protocol.
2. LoRa on ham bands at 2m, 1.25m, 70cm and 33cm bands. The link in ZR0233 shows that Semtec chips support these bands. Make 5w the nominal operating power. One should be able to harvest acceptable 5-10W PAs from $25 HTs, or at the very least, copy the design of their finals. 222MHz LoRa could provide some very interesting propagation.
3. Call me crazy, but let's put 1 & 2 together and have VoLoRa, or Voice over LoRa. Then we could transmit toll quality audio without a fancy codec!

In addition to the better digital voice that W7COM mentions, we also have some existing implementations for Amateur Radio - Baseband FM (BBFM) and Opulent Voice.

I'll expand, a bit, on W7COM's mention of LoRa to across multiple bands to generic Chirp Spread Spectrum (CSS). Because LoRa is so...

- Ubiquitous in chipsets and many different manufacturer's boards...
- Hackable (easy to integrate)...
- Works so well...

- Inexpensive...

... it's easy to forget that LoRa® is a proprietary implementation of CSS owned by Semtech. This is very similar to the situation with most digital voice implementations in use in Amateur Radio depending on the AMBE vocoder technology owned by DVSI. I've seen a few mentions that Semtech has gotten "testy" over work-alike / interoperable implementations of LoRa such as in GNU Radio (but in fairness to Semtech... they don't seem "hair trigger litigious" like DVSI has been over work-alike / interoperable implementations for AMBE.

Thus now that we have Software Defined Radios, and Chirp Spread Spectrum is a well understood technology (with hopefully ample prior art), it would be great to be able to implement CSS more widely in Amateur Radio, for example, as "just another mode" in the LinHT and its successors.

W7COM was (*kind-of*) prescient about Voice Over LoRa. A YouTube video - This is a New Kind of Wireless, mentioned in Zero Retries 0236 (mentioned by W7COM) discusses a new LoRa board that incorporates the 2.4 GHz band, and the description mentions:

... showing how 2.4 GHz LoRa pushes beyond text and GPS toward higher-data features like voice.

I'll "genericize" W7COM's idea of Voice over LoRa to "voice over Amateur Radio data networks". In my opinion vision of the future voice should be just another payload over "just move the bits" data networks in Amateur Radio. That is already the situation with AREDN networks transporting any payload type because it's amply fast and uses TCP/IP like the Internet.

Justin Overfelt AB3E

1. Regulatory reform - Removing symbol rate and bandwidth limits on VHF+, removing restrictions on what emissions can be where, etc. Really most important is removing things right now. We can't experiment with the good stuff if we're not allowed to!

2. A Western Hemisphere Geosynchronous Earth Orbit (GEO) payload or satellite for use by Amateur Radio. We simply must have it, any way possible.

3. Attract NewTechHams to Amateur Radio. I think #1 and #2 serve this goal among other approaches.

4. Public Key Infrastructure (PKI) - ARRL could publish their Root Certificate and every Logbook of the World user's Public Key. There is currently no centralized (or distributed) PKI capability in Amateur Radio.
(Posted in reply to K0JEG.)

I agree with all of AB3E's points, all previously discussed in Zero Retries.

Jason McCormick N8EI

(Significantly paraphrased)

1. Deemphasize EMCOM.

2. Improve engagement by emphasizing fun events and group build projects.

3. Improve interoperability with use of systems based on open standards (example - M17 Project) and networking technology such as TCP/IP.

I agree with all of N8EI's points. We might be able to fix the interoperability issue with a combination of "just throw more computer power at it", Machine Learning (automatic recognition), and user-defined Software Defined Radios.

John Kreno N3XKD

1. Regulatory reform, relaxing of bandwidth and symbol restrictions
2. Better community organization around co-ordination and standards (HAM Standards Body?)

Chuck Till K4RGN

1. Automated message origination and delivery system for Health and Welfare (H&W) messages, accessible by individual hams who are certified to operate it.

In my opinion, this isn't in (direct) opposition of the de-emphasis of Emergency Communications as this could be *personal* Emergency Communications. Example - providing H&W outgoing messaging for one's neighborhood.

We have two such systems... but they're only usable within Amateur Radio - Winlink (HF / VHF / UHF) and The Packet Radio Forwarding Network (TPRFN). PiGate was a (now discontinued) project to provide a public web page via a captive web portable accessible via Wi-Fi (typically, in a mass casualty shelter scenario) for composing messages to be forwarded via Amateur Radio data networks such as AREDN, New Packet Radio, TPRFN, and Winlink.

Cale Mooth K4HCK

1. Outreach to young professionals with strong recognition that that group is going to have just enough time and disposable income to support at least a small amount of involvement in the hobby. I'd argue the best way to do this is through local ham clubs working with other groups like local makerspaces and every adjacent local meet-up (software developers, hardware developers, etc.).
2. Outreach to college students.

I agree with both these points, but college students are even more time-constrained and budget-constrained than young professionals. Combining with K4HCK's first point, perhaps the most effective way to do outreach to college students is to offer direct support by interested and compatible Amateur Radio Operators to "Radio Clubs". *(Note - many college radio clubs are now becoming "Wireless clubs" or "Radio clubs" to de-emphasize the perceptions of legacy Amateur Radio.)* Example - there is significant external involvement with the HamSCI program based at the University of Scranton (Pennsylvania, USA).

David Billstrom N4SZ

(Significantly paraphrased)

1. Deemphasize EMCOM.
2. Emphasize the intersection of computer and networks and radio.
3. Emphasize interoperability

Steve Davidson K3FZT

(Significantly paraphrased)

Same points as N8EI and N4SZ.

Wes Plouff AC8JF

1. Get a geosynchronous (or long orbital period) amateur satellite into orbit covering North America. Along with this, devise ground stations that are easy to reproduce on hobby budgets.

2. Make open, non-proprietary digital voice modes widely available, built in to equipment or as add-ons.

3. Develop open, non-proprietary DSP software for transmitter builders, with the goals of efficiency (polar modulation) and clean signals (amplifier linearization).

I think that AC8JF's #3 is at least partially addressed with numerous GNU Radio flowgraphs. We also now have some open source implementations of "Raspberry Pi of radios"; example - CaribouLite RPi HAT.

Collin McConkey KE8RXN

1. Digital data modes are the most attractive feature about amateur radio to my demographic, not voice. Open-source voice is good, but we prefer data over voice for daily communication as it stands. We text far more than we talk on the phone. The same approach generally applies to our use of amateur radio. Utilizing analog FM to talk on repeaters is not our primary use case for ham radio.

2. HF fascinates several young IT professionals in my conversations with them - we understand that we can communicate regionally and globally with existing infrastructure. However, being able to do it with our own infrastructure (again, predominantly on digital modes like FT8) is quite attractive.

3. Local mesh networking is hugely popular with younger IT professionals. If projects like IP400 gain more popularity, there is a market for them (e.g., see the popularity of Meshtastic and Meshcore).

Phil Marquis K6HSV

1. EMCOMM is way overrated. It's always been a stepchild.

2. Keep showing the advances in digital comms plus show the convergence of operating modes.

Glenn Allison N3MEL

(Significantly paraphrased)

1. ARRL isn't working for Amateur Radio - too much politics and not enough involvement in actual Amateur Radio operations.

2. ARRL and other groups should work on recruitment and retention of younger people's involvement in Amateur Radio, and promote Amateur Radio as relevant to them.

3. Local groups need to promote training and participation in groups and networks.

Eric Grumling K0JEG

(Significantly paraphrased)

1. I'd like to see a distributed database for contact logging. One that has a standard real-time interface and could be implemented on simple hardware like an ESP32 level chip.

2. Real time contact dashboards? This could easily become a modern spotting network showing a global snapshot of band conditions at any given moment, contesting and special events. Heck, even livestreams and play by play. Who wants to wait 6 months to find your score?

"Gamification" is a significant factor in increasing participation in Amateur Radio, such as Parks On The Air (POTA) and Summits On The Air (SOTA).

Jim Shepherd W6US

1. Development of inexpensive small all-mode radios for use in all microwave bands up to 100 GHz. Radios must have USB connection for various modes and content. Should be 12 Vdc powered.

2. Really good basic level publications on GNU Radio that will allow the majority of ham operators to understand and use this powerful tool.

3. Educate Technician class operators about the world of ham radio beyond a cheap handheld to kerchunk local repeaters.

W6US's #1 is a challenge (or, a "fertile area of experimentation") to get to 100 GHz. The max frequency of two reasonably-priced, small, USB-powered Software Defined Transceivers - ADALM-PLUTO and LimeSDR Mini 2.0 is **3.8 GHz**. A series of "simple" transverters based on exacting printed circuit board fabrication is probably feasible.

I plan to address W6US's #3 partially (or comprehensively) in my book (in progress) **Zero Retries Guide to 21st Century Amateur Radio**. But I also identified a need for a more focused book for prospective and new NewTechHams loosely titled **"I'm a Ham - *Now What?*"** that addresses all of the Zero Retries Interesting aspects of Amateur Radio that are relatively easy and inexpensive. Examples:

- Build a TinyGS LoRa-based satellite ground station,
- Use Ribbit for easy data communications using a smartphone app with *any* portable radio
- Build a simple, inexpensive WSPR receiver, and
- Build your own inexpensive, high performance VHF / UHF omnidirectional outdoor antenna (scroll to bottom of page).

Bob Witte K0NR

(Significantly paraphrased)

1. Don't lead with EMCOM. Served agency EMCOM is naturally declining. Encourage personal EMCOM capabilities.

2. Follow up with the FCC on regulatory relief of symbol rate limits and bandwidth limit on the VHF / UHF bands will enable innovation in faster data transmissions on those .

Douglas Datwyler WR7O

(Significantly paraphrased)

1. Pay attention to the commercial interests that will make anything we do moot. If we aren't watching, ham radio frequencies will be taken.

2. Encourage LoRa / CSS used in Meshtastic, Meshtastic, MeshCore, and others that are still to come. Operate them on any band we can (after bandwidth/data rate constraints are lifted).

3. Encourage / use AREDN on 902-928 MHz band when, for those like me, using 5 GHz isn't feasible (terrain or tree cover).

Alexander von Obert DL4NO

(Significantly paraphrased)

1. Don't lead with EMCOM. Served agency EMCOM is naturally declining. Encourage personal EMCOM capabilities.

Dan Romanchik KB6NU

(Significantly paraphrased)

1. An "omnibus" web reference for Amateur Radio is AC6V's Amateur Radio & DX Guide. Although its creator Rod Dinkins A6CV (Rod's son Jeff now has AV6V) has passed, this website is still online. AC6V.Com was really a monumental achievement. Recreating that, even if you could build on top of what's already there would take a team many hours to complete and maintain.

Ben Kuhn KU0HN

(Significantly paraphrased)

1. Rules updates to bring part 97 in to the realities of 2026. Part of this would be removal of symbol rate and bandwidth limits. The other regulatory issue is encryption. Part 97.1 (b) is "Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art." and (c) is "Encouragement and improvement of the amateur service through rules which provide for advancing skills in both the communication and technical phases of the art." A lack of encryption also makes amateur radio incompatible with modern internet technologies, which is a major turn off to NewTechHams. The FCC could loosen the rules a bit and permit encryption on specific bands or with specific power levels to provide for experimentation. They should also both permit and encourage encryption for controlling equipment remotely. Another solution that would also help address the cultural issues is if organization with authoritative standing in the US would both provide a service similar to what RAC has done at https://www.rac.ca/public-encryption-keys/ and publish guidelines about how encryption and cryptography can be used legally.

2. Outreach to groups where technically-minded folks congregate - makerspaces, Linux user groups, engineering conferences, technical conferences, etc.

3. More/better documentation on GNURadio, and hardware with useful power levels to use it. LinHT is a great start, but more bands/power, would really drive adoption. Something in a larger form-factor would be fine.

Chuck Hast KP4DJT

(Significantly paraphrased)

1. Remove symbol rate restrictions on US Amateur Radio. Use of encryption such as HTTPS, SSL, and SFTP is required for using common applications and Internet connectivity such as AREDN and other networks.

2. Amateur Radio demonstrated and used in schools provides students a place to do actual work with radio technology in common use today. We should promote Amateur Radio groups in schools, universities and other institutions.

3. Young people are interested in *digital* radio technology and operations, rather than legacy Amateur Radio technology and operations.

Loïc Fejoz F4JXQ

Out of those readings and my personal history, I have written a manifesto of HamRadio for the XXI°:https://w.fejoz.net/radio/2026/01/31/hamradio-manifesto/. Trying to summarize it here as 3 axis to develop I would pick:

1. An “Open Stack” and Modular RF Pile

2. Mesh Networks and Technological Resilience

3. RF Hacking and STEM Education

In his article, F4JXQ did a masterful job in thinking through his top priorities. I decided to excerpt it full as the second item in ZR > BEACON below.

Part 2 will appear in Zero Retries 0238, scheduled for publication on Friday 2026-02-13.

Please direct comments / feedback about this article to the Zero Retries email list with the #ZR0237 hashtag.

Petition for Rulemaking Filed with FCC to *Permit Limited Use of Cryptographic Protection for Certain Amateur Emergency and Resiliency Communications*

I received this from a Zero Retries reader who watches Amateur Radio filings at the FCC:

A petition was filed late last year concerning encryption in amateur radio.

https://www.fcc.gov/ecfs/document/122533192529/1

Before the
Federal Communications Commission
Washington, D.C. 20554
Petition for Rulemaking
In the Matter of:
Amendment of Part 97 to Permit Limited Use of Cryptographic Protection for Certain Amateur Emergency and Resiliency Communications
Petitioner: Justin Sostre
Call Sign: W5NKR
...

The FCC hasn’t given this a RM number, and may not do so, and only if a RM is assigned would the FCC take comments on it.

W5NKR's petition is 12 pages and provides some interesting perspectives:

- Broad use of encryption by any Amateur Radio Operator during "Emergency and resiliency operations",
- "Non-emergency / non-resiliency" use of encryption:
    - Is reserved for Amateur Radio ***Extra class*** licensees,
    - Can only be used on Amateur Radio spectrum above 28 MHz (10 meters),
    - Transmissions using encryption are limited to 100 watts with "duty cycle restrictions" (?),
    - Restricted to communications within the US, and
    - Key retention for 90 days (minimum).

My *personal, **very** cursory, **very** preliminary commentary* follows.

- I'm not opposed to the use of encryption in Amateur Radio, especially in this era. There are some valid reasons for use of encryption.
    - One primary... *need*... for at least some encryption being permitted is that Amateur Radio networks are increasingly interconnected with the Internet, and Internet protocols now by default... and *increasingly by requirement*, incorporate encryption. I don't think it's possible to "shell into" any server on the Internet *without* the use of encryption (Secure Shell - ssh, versus the old, non-encrypted Telnet protocol). There are very few websites that don't require the use of HyperText Transfer Protocol - *Secure* (https)... including the FCC website. The FCC website is the "ultimate source of truth" about the validity of an Amateur Radio Operator's license status.
    - Current FCC regulations allow the use of encryption for managing satellites given that a satellite is a high value, unique Amateur Radio system, and theoretically, a malicious command could cause an Amateur Radio satellite to de-orbit. Thus it's a reasonable extension of the use of encryption to manage other high value, "subject to malicious command" Amateur Radio systems such as repeaters, repeater interconnections, high profile (mesh) network nodes, updating software and firmware over Amateur Radio spectrum (including automatic updates), managing remote radio systems such as an HF radio that is remote-controlled for club use, etc.
    - And, yes, of course, some emergency communications scenarios.

One of W5NKR's stated goals is that use of encryption would create a "trusted" Amateur Radio communication capability. *I kind of get that* - I'll guess that every reader has heard of cases of "spoofing" (false identification) being used in Amateur Radio - on repeaters, on HF, either someone using another Amateur's callsign, or a imaginary callsign, or none at all.

But "trusted" communications do not necessarily have to be *encrypted*. There is also *authentication*, which hasn't yet been very well explored in Amateur Radio. While it's not actually authentication, many commercial and in public safety radio systems such as P25 and DMR, each radio transmits a unique radio identification in addition to a network identification. If a P25 or DMR radio is stolen, it can be "blacklisted" as having been stolen, and its ability to be used in a network (trunking repeaters) is limited. That radio ID is a limited form of authentication - it's known that a specific radio identification is a specific (physical) radio. *(Admittedly, this is a strained analogy.)*

A better example of the use of authenticated transmissions in Amateur Radio is the experimental implementation of cryptographic signing in **M17**, discussed in **Zero Retries 0159** - **M17 Experimental Authentication Signatures**:

Finally some good news regarding digital signatures. I've been experimenting with ST's CMOX library and just got 160-bit ECDSA to run on the Module17. It takes around 8.25 ms to sign a 16-byte M17 voice stream digest. The signature can be appended to the voice stream. The curve used is Brainpool P-160 R1, with secp256r1 signing takes a tad under 15 ms.

Note this is experimental digital signature *appended* to a transmission in a manner similar (at least in my mind) to the way Forward Error Correction, or a Cyclical Redundancy Checksum (CRC) is also appended to a transmission. While the goal of the M17 experiment was to authenticate the *sender* of the transmission... it seems to me that the content of every transmission could be similarly authenticated with a "super CRC" (I'm sure there's already a name for such technology).

My too-verbose point of the above is that *encryption* is not necessarily required if *trusted* communications (as opposed to *private* communications) is the goal.

I plan to study this proposal in depth in the coming week provide more in-depth commentary in a future issue of Zero Retries.

Please direct comments / feedback about this article to the Zero Retries email list with the #zr0237 and #encryption hashtags.

ZR > BEACON

By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

Happy 10th Anniversary of MMDVM's Creation

Jonathan Naylor G4KLX on the OpenDV email list:

Happy Birthday to us!

Well this is embarrassing..... Today [2026-01-15] marks the tenth anniversary of the first release of the MMDVM, plus one day. Despite putting the anniversary in my calendar, I completely failed to notice that the day had come and gone, it was yesterday the 14th January. So in 2016 I moved my source code from a private GitLab repository to a public GitHub one. An announcement was made on the old Yahoo! groups and waited for the bug reports. This is the commit from the MMDVM firmware:

commit dd17a47972192a0ff448fb6842b5bef1c783bd34
Author: Jonathan Naylor <naylorjs@...>
Date: Thu Jan 14 18:57:21 2016 +0000 Initial commit

The first version only supported the Arduino Due as the modem hardware (hotspots would come later in the year), and the MMDVM Host would compile and run under Windows and Linux, and still does. The first version only supported D-Star and DMR, System Fusion and P25 phase 1 would appear later in 2016.

The D-Star side was straightforward to implement, I had been developing for that mode since 2009 and knew it well, but DMR represented a new level of complexity not just in the design of the protocol, but also in its requirements for timing synchronisation between the transmitter and receiver. I had it

down to approximately 42 microseconds, and it was then that we found that the clock oscillator on the Due wasn't good enough to maintain a proper lock. We were used to needing good oscillators for radio frequency setting, but needing it for proper operation of a modem operating at audio type frequencies was new to us.

In comparison all newer modes have been relatively simple to implement, although the documentation for the ham only modes has been lacking, and I do wonder if that was done to try and get competitive advantage, yes I'm looking at you Yaesu. Some companies even threatened me with law suits for implementing their on-air protocol, until I pointed out that US law doesn't apply in the UK, yes I'm looking at you Yaesu.

Most companies I've dealt with have been really open and helpful, even if they didn't want it publicised, but some have been completely closed to approaches, yes I'm looking at you Yaesu. I'm an Icom guy away from the MMDVM so it's no skin off my nose.

One of the strangest requests I received came from a US federal agency that wanted to use my P25 work in their systems. Normally I would welcome such an approach, but that could put my work in the category of "safety of life" and I didn't want that level of stress, after all the MMDVM is a hobby based system. I thanked them for their approach and suggested that they talk to Motorola for that level of support. I have worked on safety critical embedded systems and am familiar with the reliability requirements, but the MMDVM isn't at that level, after all I wanted to have something written and working in months/years rather than in decades.

So here we are, ten years and one day later, the MMDVM has grown to encompass more modes, and gone in directions I never expected like POCSAG support. We don't have exact numbers for the number of MMDVM systems out there, but we're pretty sure that it is over 100,000 systems of all sorts running either as hotspots or as repeaters.

We're currently working on new hardware and software, and the results will be exciting once they're deemed good enough, this is thanks for an ARDC grant that has allowed us to investigate interesting new chips and then develop for them. We hope to have something to announce before the heat death of the universe.

I would like to have included a list of people who have contributed to the MMDVM over the years, but it would be a huge list, and I would still be in danger of missing important players off. So all I can say is, you know who you are, and I thank you for all of your support over the years. The loss of the old Yahoo! group messages hasn't helped matters either.

Multi Mode Digital Voice Modem (MMDVM) is truly a remarkable achievement and a primary example of technological innovation in Amateur Radio... *that probably no one would have thought possible, until G4KLX did it*. Before MMDVM, typical (and probably current) commercial / government practice of "integrating" multiple modes, or "interoperability" was to purchase one of every different kind of radio, and add a simple audio / control cross-connect matrix. I've seen this approach implemented in numerous emergency communications vehicles, an entire rack of radios.

Thus Amateur Radio, using MMDVM, is way, way ahead of the commercial state of the art. I'll guess that MMDVM's Open Source code has by now found its way into Software Defined Receivers (*or could...*) so that we can have "all channel / any mode" receivers, such as KA9Q has discussed in his personal system using his ka9q-radio project where he decodes *and records* all of the activity on Amateur Radio repeaters in the San Diego, California area.

I've periodically followed, and communicated with G4KLX and others involved in MMDVM development, and the stuff they're working on currently as a result of their latest grant from ARDC is...

next level... like transcoding between many (but unfortunately, not *all*) Amateur Radio digital voice systems, and using new and more capable radio chipsets.

While G4KLX certainly deserves the credit for *doing* the work on MMDVM... I think there's also some credit due to ARDC for *funding two grants*, in 2023 and 2024 *(search for MMDVM)* to fund G4KLX being able to return to focused work on updating and extending the technology underpinning MMDVM.

Hamradio Manifesto: From Utility to Creativity

Loïc Fejoz F4JXQ on his blog / website:

The current approach to amateur radio, focused on communication and disaster relief, is no longer sufficient to attract today's technical profiles. This manifesto defines a strategic transition: moving from passive use to the design of resilient and innovative communication systems. It must return to what it was at its origin: the avant-garde of wireless experimentation. This manifesto proposes a return to a logic of construction by transforming the radio spectrum into a global innovation laboratory.

The Waves as a Creative Space

Public utility should no longer be our only selling point, but the result of our technical excellence.

- *Development axis:* ***Prioritize the design of experimental digital protocols****, signal processing optimized by the modern techniques available (MCU, CPU, DSP, GPU, FPGA, NPU, etc.).*
- *Target:* ***Captivate Makers, Hackers****, and engineers by offering a prototyping environment.*
- *The Vision: One no longer joins amateur radio to wait for a network failure, but to* ***build what industry cannot, or is not interested in, inventing****.*

For an "Open Stack" and Modular RF Pile

The current market relies on closed proprietary equipment (black boxes). The priority is now the opening of all hardware and software layers.

- *Hardware/Software Decoupling: Separate the physical "Muscle" (amplifiers, filters) from the "Brain" (DSP, software). The user must be able to* ***interchange their radio's intelligence*** *just as they change a Linux distribution.*
- *Standardization: Allow developers to interact directly with the hardware via* ***open APIs, standardize I/Q flows****, and other flows between layers.*
- *Accessibility: Encourage the development of fully open-source RF stacks to* ***lower the barrier to entry for experimenters****.*

Mesh Networks and Technological Resilience

Develop a decentralized data infrastructure, independent of cellular networks and the commercial Internet, tolerant of delays and intermittency. The goal is to complement traditional traffic for more experimentation and diversity.

- ***Independent Backbone****: Create a* ***world-wide HF/VHF data network****, capable of carrying text and images without any dependence on critical infrastructure or the Internet.*

- ***Dynamic protocol negotiation – Hailing**: Establish smart calling (hailing) channels. By dynamically announcing details, modulation, and application layers of the used protocol (through initiatives like HQFBP and its announcements), we enable unprecedented agility and diversity of modes, while maintaining interoperability.*

- ***Amateur Radio as a Service**: Democratize access to the waves for operators without the possibility of fixed antennas via networks of remote stations shared in the cloud.*

RF Hacking and STEM Education

Amateur radio must once again become the school of technical curiosity.

- *Protocol Analysis: **Encourage reverse-engineering** of radio protocols (proprietary IoT, LoRa, Sigfox, Bluetooth, Wifi, etc.) and satellite links to understand, learn, optimize, and secure.*

- *STEAM 2.0 Kits: **Develop "turnkey" pedagogical tools** linking radio to popular or school education activities (Science, Technology, Engineering, Art, and Mathematics).*

- *Gamification: **Modernize engagement** through mobile applications like "POTA/SOTA/xOTA" as vectors for real-world hardware performance testing. These challenges must be designed to captivate 16-25 year olds as well as experienced professionals.*

Conclusion: Building to be Useful

*By prioritizing **creativity and technical openness**, we form a community of experts capable of responding to many technical innovation and usage challenges. This community is the engine that keeps the tool ready for emergencies. Paradoxically, it is through this creative transformation that **amateur radio will find its full utility!***

I can't offer any significant context to offer, and certainly no criticism, of F4JXQ's *excellent* and thought-provoking summation of Zero Retries Interesting / NewTechHams / ***Modern and future-oriented***... view of **what Amateur Radio should be aspiring toward**s.

Is The "Mini" Better for Data Modes? (Video)

Craig Lamparter KM6LYW on his KM6LYW Radio YouTube Channel (Home of the DigiPi Project):

Let's compare the original Baofeng UV5R to the new Baofeng "Mini." Which has a better receiver? Which is better for packet/APRS radio? We'll test both along with a couple of Yaesu's to find out!

I was fascinated with this video!

The referenced "Mini" is the Baofeng UV5R Mini (link from KM6LYW Radio YouTube channel). The context is the use of portable radios for use with the DigiPi project. The combination of the DigiPi and an All In One Connector (AIOC) makes for a low cost way to explore Amateur Radio data communications. The original Baofeng UV-5R was infamous for being susceptible to desense from any nearby source of significant radio energy, such as broadcast FM stations.

In a side-by-side comparison of an original UV-5R, a Yaesu portable radio, and the UV-5R Mini, the Mini does not suffer from the UV-5R's desense problem. In fact, it worked *nearly as well as the Yaesu* in receiving 1200 bps AFSK packet radio transmissions (APRS) on 144.39 MHz.

OK... cool... nice that this unit isn't "deaf" like the bigger, earlier version. *But what's the big deal*?

Two UV-5R Minis, four antennas, batteries, USB-C charging cables, earpiece, etc. is $35 at Amazon!
(Link is from the KM6LYW Radio YouTube description.)

There's *some* understandable cost savings from the vendor not supplying charger cradles (the battery has a USB-C connector) or AC to USB-C chargers... but even with those savings, that's an ***insanely low cost of $17.50 per radio*** that (KM6LYW claims) performs pretty decently. What's even more surprising is that the radios can be programmed (per the Amazon description) from a smartphone app via Bluetooth.

KM6LYW only briefly mentions that the audio adapter he used for his testing with the portable radios is an All In One Cable (AIOC) - a minimalist combination of audio adapter and programming adapter in one unit. An AIOC has a small form factor and integral connectors for use with portable radios. KM6LYW recommends an AIOC by Temporarily Offline, but I recommend the AIOC by NA6D.

At the moment, I don't plan to use UV-5R Minis for anything serious... but *they seem ideal*, at least from a cost / performance aspect, for a number of very localized demonstration scenarios I have in mind. I also have a number of TNCs in Zero Retries Labs that I need to test out and see if they work, and the UV-5R Mini and a few easily fabricated cables seem ideal for that task.

A "quantity" 🤣 of UV-5R Minis are scheduled to arrive this weekend. *More* radios...

NASA Selects Participants to Track Artemis II Mission

The article names four individuals, all of whom I think are hams in North America:

- Chris Swier (K1FSD, I think), South Dakota - https://www.qrz.com/db/K1FSD
- Dan Slater AG6HF, I think), California - https://www.qrz.com/db/AG6HF
- Loretta A Smalls (AJ6HQ, I think), California - https://www.qrz.com/db/AJ6HO
- Scott Tilley (VE7TIL), Canada - https://www.qrz.com/db/VE7TIL

These were pretty cool too:

Non-Profit & Amateur Radio Organizations:

- AMSAT Argentina, Argentina
- AMSAT Deutschland, Germany
- Amateur Radio Exploration Ground Station Consortium, Towson, Maryland
- CAMRAS, Netherlands
- Deep Space Exploration Society, Kiowa County, Colorado
- Neu Golm Ground Station, Germany
- Observation Radio Pleumeur-bodou, France

Official recognition from a US government agency that Amateur Radio is capable of materially contributing to space science and space communications!

A HamClock Server Alternatives Presages Many HamClock Options?

I was one of the first to spot the announcement of open-hamclock-server project early this week (including alerting Amateur Radio Newsline), and wow, *that* Zero Retries Interesting story ***just completely blew up*** in Amateur Radio media. Most Amateur Radio "general interest" YouTube channels covered this development pretty breathlessly, but I prefer to link to the more sober coverage of this development:

- open-hamclock-backend Aims to Keep HamClock Ticking in **Amateur Radio Daily**2026-02-03
- An Open-Source Effort To Salvage Hamclock in **Amateur Radio Newsline** Report 2519 for Friday, February 6th, 2026

An outgrowth of this development that I think most folks don't understand (at least, I haven't seen this possibility mentioned) is that now that "HamClock Server" has essentially been made open source...

anyone or any group can create a new, unique HamClock server - with varied and unique content being supplied to HamClock users.

For Amateur Radio data communications networks that operate on the TCP/IP (IPv4 - I'm guessing...) protocol could be used to supply HamClock displays with unique information from / about that network.

I'm certainly not committing (or seriously considering - *yet*) that I'll develop a a *Zero Retries*HamClock server to supply Zero Retries content to HamClock users... *but I could*. ARRL could do so for their fans. Less popular mode "spots" could be promoted via HamClock, such as M17 net schedules and active conversations. AREDN could provide network announcements. It will probably be possible, soon enough, to create a HamClock server with content specific to an audience of one - your own, unique source of content about your Amateur Radio systems, news that you specifically care about.

Let thousands of HamClock servers bloom!

Lastly, we HamClock fans owe a huge debt of Thanks to Silent Keyboard Elwood Downey WBØOEW for creating HamClock. Learning more about HamClock, WB0OEW must have been a heckuva server guru to supply data to many HamClock users worldwide. HamClock was a great example of technological innovation in Amateur Radio.

I also think that related debt of Thanks is due to **Michael Burmeister-Brown** of Inovato for creating the Quadra / Quadra 4K - inexpensive, turnkey units that could be dedicated to use as HamClock *appliances*. In my opinion, the availability of the Quadra and Quadra 4K ***popularized*** HamClock and brought it into widespread recognition and use because you didn't have to share a computer to display HamClock. Unfortunately, Michael has announced that he has a terminal illness and is closing down Inovato.

New Comedy Podcast Tackles Ham Radio's "Gatekeeping Problem" With Humor and Education

Amateur Radio Daily 2026-01-20:

New Comedy Podcast Tackles Ham Radio's "Gatekeeping Problem" With Humor and Education

Guy and Gus launch innovative series as survey data reveals 73% of new operators feel intimidated by online ham radio communities

Orlando, FL – January 20, 2026 – As amateur radio experiences a post-pandemic surge in new licensees, a troubling trend has emerged: online communities have become battlegrounds where

“real radio” debates and equipment tribalism drive newcomers away from a hobby designed around experimentation and connection.

Ham Radio Gizmos is tackling this challenge head-on with an innovative solution: a comedy podcast that makes learning fun again.

The show centers on twin brothers Guy and Gus Wyre, whose constant disagreements mirror the hobby’s most heated debates. Guy champions modern software-defined radios, digital modes, and computer integration. Gus lives for vintage tube equipment, heavy iron, and radios that glow before they transmit. Their sibling rivalry becomes the vehicle for education – proving both approaches have merit while reminding listeners that ham radio is big enough for everyone.

...

That... is something that I didn’t realize that Amateur Radio *needed* - a ***comedy*** *podcast*, especially with a Zero Retries Interesting perspective:

Guy champions modern software-defined radios, digital modes, and computer integration.

But as soon as I read about it... heck yeah... I’m sure that I’ll likely become a committed fan!

Explore the Stratosphere With a DIY Pico balloon
A tiny ham-radio transmitter lets you track a balloon globally

David Schneider N4LVD in **IEEE Spectrum**:

There’s an interesting development in amateur ballooning: using so-called superpressure balloons, which float high in the atmosphere indefinitely rather than simply going up and up and then popping like a normal weather balloon. Superpressure balloons can last for months and travel long distances, potentially circumnavigating the globe, all the while reporting their position.

You might imagine that an undertaking like this would be immensely difficult and cost thousands of dollars. In fact, you can build and launch such a balloon for about the cost of a fancy dinner out. You just have to think small! That’s why amateur balloonists call them pico balloons.

The payload of a pico balloon is so light (between 12 to 30 grams) that you can use a large Mylar party balloon filled with helium to lift it. They’re also inexpensive; that’s important because you won’t get your payload back. And because such diminutive payloads don’t pose a danger to aircraft, they aren’t subject to the many rules and restrictions on free-floating balloons that carry more mass.

The essential advances that made pico ballooning possible were figuring out how to track a balloon no matter where in the world it might be and how to power such tiny payloads. A lot of folks worked on these challenges and came up with good solutions that aren’t hard or expensive to reproduce.

N4LVD explains pico balloons and the technology elements in a matter of fact, but engaging style, which I envy. His bio states that he’s “... a former editor at IEEE Spectrum” and that shows. It took some digging into every link in the story until I found one that had a reference to his callsign.

*Please offer comments / feedback about **ZR > BEACON** on the Zero Retries email list with the #ZR0237 hashtag.*

Closing Thanks

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